United States Department of Agriculture	Forest Service	NA	MFO

Reply to: 3420 August 4, 1989

Subject: Beech Bark Disease Evaluation in the Allegheny Reservoir Opportunity Area

To: District Ranger, Bradford Ranger Districts

We completed a biological evaluation in June, 1989 in the Allegheny Reservoir Opportunity Area (OA) to determine the current stages of beech bark disease. This memo presents the methods and result/discussion of our evaluation, and our recommendations to reduce future damage.

Methods: A listing of all stands with 20 square feet per acre or more of beech was compiled from the VIMIS database. The stands which met the criteria for selection had their boundaries transferred from compartment maps to 1:24,000 topographic maps. Each stand boundary was found on color infrared transparencies and classified into one of the damage classes listed in Table 1. The 9 X 9 inch color infrared photography (scale: 1:12,000) was acquired during the 1988 growing season.

No stand data was available for the National Recreation Area (NRA); therefore, the aerial photography was examined for areas within the NRA which had concentrations of hardwood mortality. Ten areas with hardwood mortality were examined on the ground. Each area was inventoried using a 10 BAF prism and 5 to 10 plots were placed within the area.

At least 10 percent of the stands in none, light, moderate and severe damage classes (see Table 1) were examined in the field during May and June, 1989. Ten minutes were spent in each stand (see Table 2) examining the beech. If no beech scale (Cryptococcus fagisuga Lind.) was found then the stand examination was ceased. Stands with beech scale were sampled using a modified version of the SILVAH sampling guidelines (Marquis et al., 1984) to determine the amount of beech bark disease within a stand. At each prism (10 BAF) plot we recorded the total basal area for trees one inch or greater at d.b.h., and if there were greater than eight beech sprouts (or clumps) within a six foot radius of plot center. For each beech one inch or greater at d.b.h. we recorded the following:

1. d.b.h.

2. Tree condition: healthy (no evidence of beech bark disease), declining (chlorotic or thin crowns, or tarry spots present), or dead.

3. Amount of beech scale: < 50% or > 50% (first eight feet of the bole).

4. Presents or absents of Nectria spp. fruiting bodies.

Results and Discussion: Table 2 lists the areas in the NRA (see Figure 1) and stands which were examined and whether or not beech scale was present. No beech scale was found in the stands classified in the none or light damage classes. Beech scale was found in three stands in the moderate and severe damage classes and some of the mortality was caused by beech bark disease. The inventory results for the three stands with beech scale present are listed in Table 3. Compartment 86, stand 21 was rated in the moderate damage class, but most of the trees were dead oaks which died from stress caused by gypsy moth defoliation and the drought of 1988.

Hardwood mortality was seen in 30 areas (Figure 1) in the NRA and 10 areas were examined on the ground. Only 4 areas had beech scale present (Table 2) and some of the areas had beech mortality, but the majority of the mortality seen on the aerial photographs was dead or declining oaks, or red maples.

The incidence of beech scale infesting beech within the Allegheny Reservoir OA is very low. About 30 percent of the stands/areas checked had beech scale present and no Nectria spp. infection was seen. Generally, the beech scale is established within the northern half of the OA. The Allegheny Reservoir OA should be considered within the Advancing Front since the beech scale population is scattered and sparse, and the beech scale population is building within the OA (Houston and O'Brien, 1983). During the next ten years the scale population will increase because the wind dispersed scale (nymphs) may spread from sources within and outside (such as the North Branch Willow Creek OA) of the OA. Eventually, the scale populations will be high and beech mortality from cankering by Nectria spp. will occur.

Recommendations: Mielke et al. (1986) have developed management actions for areas within the Advancing Front. The management actions and some specific recommendations are as follows:

1. **Reduce the proportion of beech in the stand.** Two of the three stands with beech scale should be considered for this option. Remove beech with greater than five percent of the lower bole with beech scale, and remove beech with rough bark. Consider using herbicides to treat the beech to prevent sprouting of susceptible trees. We are requesting that no cutting be done in compartment 100, stand 29 because the Department of Environmental Resources has a permanent plot present in the stand. The permanent plot is examined periodically to record observations on beech bark disease development.

2. **Monitor insect and disease condition.** This evaluation is the beginning of completing this step. The twenty-six stands examined in this biological evaluation should be examined every 3 to 5 years to determine if beech scale is present, and the amount of beech infested by beech scale and/or infected by Nectria. An intensive monitoring procedure can assist is setting priorities on stands for silvicultural treatment. Usually, in the Advancing Front we have found the scale on beech trees close to a road, and/or in stands located at or near the top of a ridge.

3. **Cut heavily infested trees.** Heavy scale infested trees serve as reservoirs for the scale (nymphs) to increase the proportion of scale infested trees within a stand, and infest beech within other stands.

We did not observe any beech considered to have heavy (greater than 50 percent of the lower bole) infestations of beech scale. Beech with greater than five percent of the bole with beech scale should be removed.

4. **Treat infested understory or sprouts associated with heavily infested overstory.** None of the three stands had a heavily infested overstory. Stands which become heavily infested should be considered for herbicide treatment when a regeneration cut is performed because the component of beech sprouts may increase and interfere with some silvicultural regeneration methods (Marquis et al., 1984). Typically, sprouts from susceptible parents will become scale infested and will not die from Nectria spp. infections. These sprouts will mature and be highly defective (Houston, 1975).

5. **Leave trees with smooth bark and little or no scale and their root sprouts.** Resistant trees typically have smooth bark and little or no beech scale present. Currently, the only practical means to determine resistance is to wait for the Aftermath Forest stage of the disease to occur (fifteen to twenty years).

Please contact me (phone: 301-291-4133) if you have any questions regarding this biological evaluation.

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Table 1. Decision criteria for beech bark disease damage classes*/.

BEECH BARK DISEASE DAMAGE INTENSITY CLASS	DESCRIPTION
Light	1 - 10% OF TREES DEAD AND DYING
Moderate	10 - 25% OF TREES DEAD AND DYING
Severe	> 25% OF TREES DEAD AND DYING

BEECH BARK DISEASE DAMAGE FREQUENCY CLASS	DESCRIPTION
Clustered	< 30% OF STAND AREA
Partial	30 - 60% OF STAND AREA
Widespread	> 60% OF STAND AREA

The damage class for each stand was labeled in Table 2 using the following coding matrix:

CODING MATRIX FOR BEECH BARK DISEASE DAMAGE CLASSES

INTENSITY CLASS	CLUSTERED	PARTIAL	WIDESPREAD
Light	LC	LP	LW
Moderate	MC	MP	MW
Severe	SC	SP	SW

*/ Taken from Acciavatti and Dropp (1986). The beech bark disease damage frequency class "Clustered" was originally referred to as "Scattered".

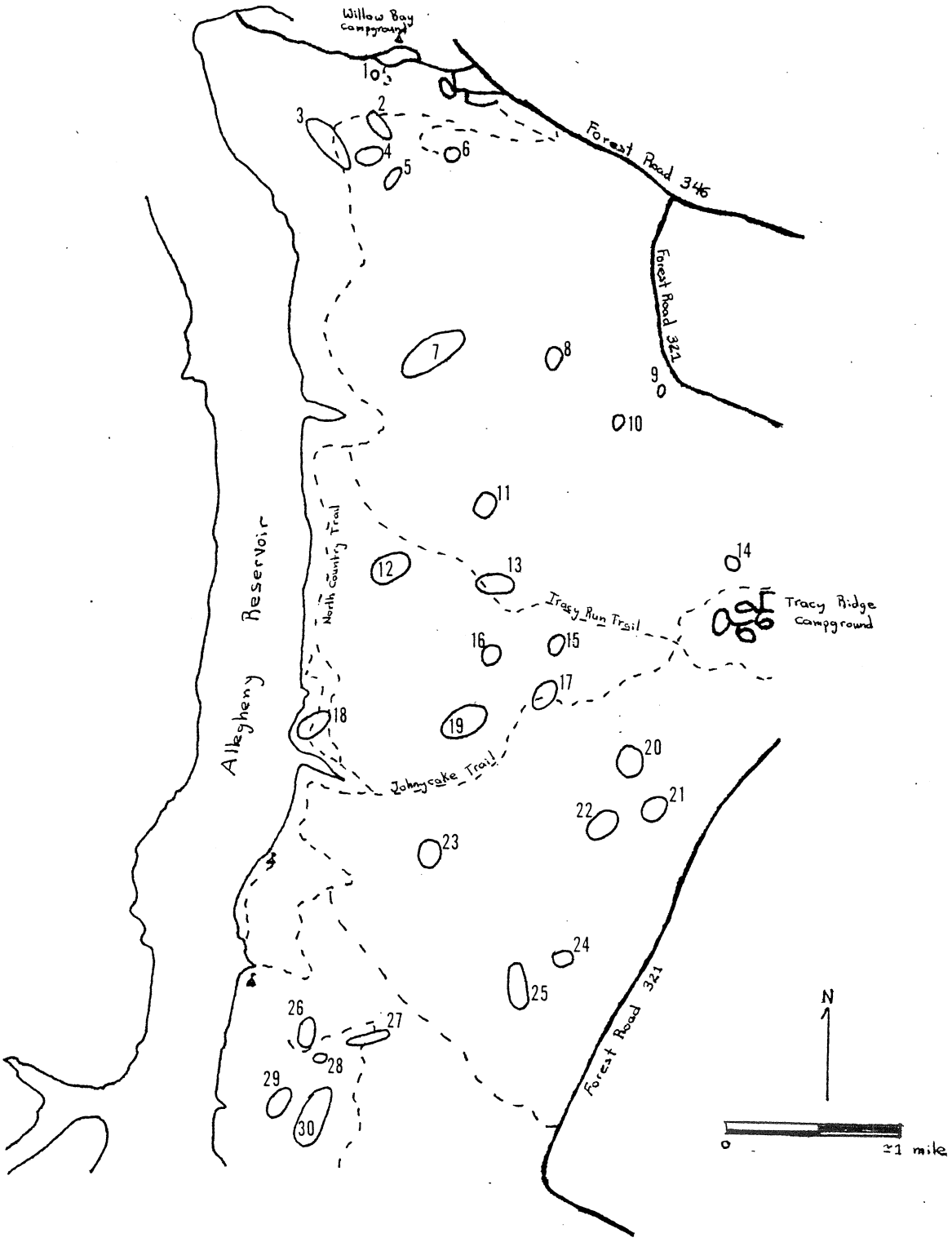

Figure 1. Areas with hardwood mortality within National Recreation Area of the Allegheny Reservoir Opportunity Area, Bradford Ranger District, Allegheny National Forest, 1989.

Table 2. Stands and areas examined*/, and damage classes**/ assigned using aerial photography for the Allegheny Reservoir Opportunity Area, Bradford Ranger District, Allegheny National Forest, 1988.

Compartment	Stand/ Area	Acres	Total Stand Basal Area (sq. ft./ ac.)	Stocking Percent	American beech Basal Area (sq. ft. / ac.)	Damage Class	Is beech scale present?	Notes
NRA	1	3					Yes	
NRA	2	9					Yes	
NRA	3	17					No	
NRA	4	6					No	No beech present
NRA	5	4					No	No beech present
NRA	6	6						
NRA	7	33						
NRA	8	6						
NRA	9	3					No	
NRA	10	4						
NRA	11	7						
NRA	12	20					No	No beech present
NRA	13	10					Yes	
NRA	14	5					No	
NRA	15	5						
NRA	16	6						
NRA	17	9					Yes	
NRA	18	12						
NRA	19	19						
NRA	20	11						
NRA	21	10						
NRA	22	13						
NRA	23	10						
NRA	24	6						
NRA	25	14						
NRA	26	9						
NRA	27	9						
NRA	28	3						
NRA	29	7						
NRA	30	27						
42	13	132	150	98	24	LC	No	
42	18	48	130	99	20	LC	No	
48	19	68	140	99	20	MP		
51	22	60	100	90	34	none		
55	20	116	130	88	20	LC		
55	22	51	110	99	72	LC		
55	30	47	120	74	21	LC		
55	31	73	90	79	20	LC		
56	17	23	110	94	23	LC		
56	19	25	130	99	21	none		

*/ Acres, Stocking Percent, and American beech basal area are taken from VIMIS.

**/ See Table 1 for damage class codes.

Table 2. Continued */ **/

Compartment	Stand	Acres	Total Stand Basal Area (sq. ft./ ac.)	Stocking Percent	American beech Basal Area (sq. ft. / ac.)	Damage Class	Is beech scale present?	Notes
63	22	31	100	71	21	none		
76	7	38	120	0	20	none		
76	22	25	120	90	28	none	No	
78	1	112	80	59	23	LC		
79	5	17	170	90	28	none		
79	14	88	150	52	44	LC	No	
79	16	27	100	79	25	LP	No	
86	12	21	140	99	29	LC		
86	21	46	100	64	20	MW	No	
89	15	34	110	84	25	none	No	
90	18	37	130	99	25	none	No	
90	29	14	130	97	22	LC		
92	40	46	100	78	23	LP	No	
100	28	45	140	99	23	SW	Yes	
100	29	8	140	99	30	SW	Yes	permanent plot
100	30	95	120	99	52	MW	Yes	

*/ Acres, Stocking Percent, and American beech basal area are taken from VIMIS.

**/ See Table 1 for damage class codes.

Table 3. Inventory results*/ for stands with beech scale within the Allegheny Reservoir Opportunity Area, Brandford Ranger District, Allegheny National Forest, 1989.

Compartment	Area	Number of Plots	Stand BA/AC.	% Plots 8+ Beech at Center	AMERICAN BEECH Category	BA/AC.	% BA/AC.	STOCK. %	VOLUMES (BF/AC.)	(CDS/AC.)	(CF/AC.)
NRA	1	5	72	80	DEAD	18.0	56.2	8.0	810.9	264.9	443.2
					DECLINING	14.0	43.7	6.2	664.7	203.8	345.5
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	.0	.0	.0	.0	.0	.0
					HEALTHY	.0	.0	.0	.0	.0	.0
					TOTAL	32.0		14.2	1475.6	468.7	788.7
NRA	2	9	90	33	DEAD	.0	.0	.0	.0	.0	.0
					DECLINING	8.9	38.1	7.1	499.9	121.6	218.1
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	3.3	14.3	2.7	71.4	52.4	75.7
					HEALTHY	11.1	47.6	8.9	404.0	166.7	264.1
					TOTAL	23.3		18.6	975.3	340.7	557.8
NRA	3	10	91	0	DEAD	.0	.0	.0	.0	.0	.0
					DECLINING	.0	.0	.0	.0	.0	.0
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	.0	.0	.0	.0	.0	.0
					HEALTHY	2.0	100.0	1.8	.0	26.4	33.0
					TOTAL	2.0		1.8	.0	26.4	33.0
NRA	9	5	102	0	DEAD	4.0	100.0	1.8	71.9	63.2	89.2
					DECLINING	.0	.0	.0	.0	.0	.0
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	.0	.0	.0	.0	.0	.0
					HEALTHY	.0	.0	.0	.0	.0	.0
					TOTAL	4.0		1.8	71.9	63.2	89.2
NRA	13	5	118	0	DEAD	.0	.0	.0	.0	.0	.0
					DECLINING	.0	.0	.0	.0	.0	.0
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	6.0	37.5	2.7	250.2	88.7	145.1
					HEALTHY	10.0	62.5	4.5	317.4	141.7	220.3
					TOTAL	16.0		7.1	567.5	230.4	365.4
NRA	14	5	86	20	DEAD	.0	.0	.0	.0	.0	.0
					DECLINING	2.0	50.0	.9	92.5	29.4	49.6
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	.0	.0	.0	.0	.0	.0
					HEALTHY	2.0	50.0	.9	.0	17.6	22.0
					TOTAL	4.0		1.8	92.5	47.0	71.6

*/ Stocking percent and volumes calculated using SILVAH equations (Marquis et al., 1984).

Table 3. Continued */.

Compartment	Stand/ Area	Number of Plots	Stand BA/AC.	% Plots 8+ Beech at Center	AMERICAN BEECH Category	BA/AC.	% BA/AC.	STOCK. %	VOLUMES (BF/AC.)	(CDS/AC.)	(CF/AC.)
NRA	17	5	136	0	DEAD	.0	.0	.0	.0	.0	.0
					DECLINING	2.0	20.0	.9	131.6	27.5	52.1
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	4.0	40.0	1.8	81.1	58.4	84.4
					HEALTHY	4.0	40.0	1.8	174.5	58.9	97.5
					TOTAL	10.0		4.4	387.2	144.8	234.0
100	28	17	148	5	DEAD	1.2	7.7	1.8	39.8	17.9	28.0
					DECLINING	.6	3.8	.9	49.3	7.7	16.0
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	.6	3.8	.9	8.5	9.3	12.9
					HEALTHY	12.9	84.6	19.7	337.3	186.5	280.2
					TOTAL	15.3		23.2	434.9	221.4	337.0
100	29	8	140	0	DEAD	.0	.0	.0	.0	.0	.0
					DECLINING	2.5	10.5	1.8	140.1	35.5	63.6
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	1.3	5.3	.9	35.2	19.4	29.2
					HEALTHY	20.0	84.2	14.2	972.6	280.0	482.2
					TOTAL	23.7		16.8	1147.9	334.9	575.0
100	30	22	123	4	DEAD	2.7	8.3	5.3	103.8	40.4	64.6
					DECLINING	4.5	13.9	8.9	228.1	63.6	109.9
					NECTRIA	.0	.0	.0	.0	.0	.0
					SCALE	1.8	5.6	3.6	67.7	26.9	43.0
					HEALTHY	23.6	72.2	46.2	1013.4	333.6	554.5
					TOTAL	32.7		63.9	1413.0	464.6	772.1

*/ Stocking percent and volumes calculated using SILVAH equations (Marquis et al., 1984).